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(54) HONEYCOMB STRUCTURE AND METHOD FOR PRODUCING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a honeycomb structure which contains refractory particles such as silicon carbide particles, can be produced at a relatively low sintering temperature at a low cost, is sufficiently porous, has a high specific surface area, and can suitably be used as a filter or a catalyst carrier for cleaning automotive exhaust gases under a high SV condition.

SOLUTION: This honeycomb structure divided with bulkheads to form many flow holes penetrated in the axial direction, characterized by containing refractory particles and a glassy component and being porous.

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(54) 【発明の名称】 ハニカム構造体及びその製造方法

(57) 【要約】

【課題】 炭化珪素粒子のような耐火性粒子を含みながらも比較的低い焼成温度で安価に製造できるとともに、十分に多孔質かつ高比表面積で、自動車排ガス浄化用のフィルターや触媒担体等として高SV条件下でも好適に使用できるハニカム構造体を提供する。

【解決手段】 隔壁により仕切られた軸方向に貫通する多数の流通孔を有するハニカム構造体であって、耐火性粒子とガラス質成分とを含み、多孔質であるハニカム構造体。

【特許請求の範囲】

【請求項 1】 隔壁により仕切られた軸方向に貫通する多数の流通孔を有するハニカム構造体であって、耐火性粒子とガラス質成分とを含み、多孔質であることを特徴とするハニカム構造体。

【請求項 2】 前記耐火性粒子が、その原料粒子形状を留めた状態で前記ガラス質成分により結合された構造を有する請求項 1 記載のハニカム構造体。

【請求項 3】 前記耐火性粒子が、炭化珪素粒子である請求項 1 記載のハニカム構造体。

【請求項 4】 含塵流体中に含まれる粒子状物質を捕集除去するフィルターとして用いられる請求項 1 記載のハニカム構造体。

【請求項 5】 気孔率が 30～90%の範囲にある請求項 1 記載のハニカム構造体。

【請求項 6】 平均細孔径が 2～50 μm の範囲にある請求項 1 記載のハニカム構造体。

【請求項 7】 前記隔壁の厚さが 102～1270 μm である請求項 1 記載のハニカム構造体。

【請求項 8】 前記隔壁の厚さとハニカム構造体の気孔率とが以下の関係を満たす請求項 1 記載のハニカム構造体。

【数 1】 隔壁の厚さ (μm) \geq 気孔率 (%) $\times 4$

【請求項 9】 前記隔壁の厚さとハニカム構造体の気孔率とが以下の関係を満たす請求項 1 記載のハニカム構造体。

【数 2】 隔壁の厚さ (μm) \geq 気孔率 (%) $\times 5$

【請求項 10】 前記隔壁の厚さとハニカム構造体の気孔率とが以下の関係を満たす請求項 1 記載のハニカム構造体。

【数 3】 隔壁の厚さ (μm) \leq 気孔率 (%) $\times 20$

【請求項 11】 セル密度が 0.7～155 セル/ cm^2 である請求項 1 記載のハニカム構造体。

【請求項 12】 耐火性粒子原料にガラス化素材と有機バインダーとを添加し混合及び混練して得られた坯土をハニカム形状に成形し、得られた成形体を仮焼して成形体中の有機バインダーを除去した後、本焼成することを特徴とするハニカム構造体の製造方法。

【請求項 13】 前記耐火性粒子原料が、炭化珪素粒子原料である請求項 12 記載の製造方法。

【請求項 14】 前記耐火性粒子原料の平均粒子径が、最終的に得られるハニカム構造体の平均細孔径の 2～4 倍である請求項 12 記載の製造方法。

【請求項 15】 前記耐火性粒子原料の不純物含有量が 5 重量%以下である請求項 12 記載の製造方法。

【請求項 16】 前記ガラス化素材が、 SiO_2 、 Al_2O_3 、 B_2O_3 及び Na_2O からなる群より選ばれる 1 種以上の酸化物を含んで構成される請求項 12 記載の製造方法。

【請求項 17】 前記ガラス化素材の添加量が、耐火性

粒子の表面積に対し 3～30 g/m^2 である請求項 12 記載の製造方法。

【請求項 18】 ガラス化素材の平均粒子径が、骨材である耐火性粒子の平均粒子径の 50%以下である請求項 12 記載の製造方法。

【請求項 19】 前記有機バインダーを、前記耐火性粒子原料とガラス化素材との合計量に対して、外配で 2～30 重量%の範囲で添加する請求項 12 記載の製造方法。

10 【請求項 20】 前記坯土を調査する際に、造孔剤を、前記耐火性粒子原料とガラス化素材との合計量に対して、外配で 30 重量%以下の範囲で添加する請求項 12 記載の製造方法。

【請求項 21】 前記成形体の仮焼を、前記ガラス化素材が溶融する温度より低い温度にて実施する請求項 12 記載の製造方法。

【請求項 22】 前記本焼成を、1000～1600℃の温度範囲で実施する請求項 12 記載の製造方法。

【発明の詳細な説明】

20 【0001】

【発明の属する技術分野】 本発明は、自動車排ガス浄化用のフィルターや触媒担体等に使用されるハニカム構造体に関する。

【0002】

【従来の技術】 ディーゼルエンジン排ガスのような含塵流体中に含まれる粒子状物質を捕集除去するためのフィルター、あるいは排ガス中の有害物質を浄化する触媒成分を担持するための触媒担体として、多孔質のハニカム構造体が広く使用されている。また、このようなハニカム構造体の構成材料として、炭化珪素 (SiC) 粒子のような耐火性粒子を使用することが知られている。

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【0003】 具体的な関連技術として、例えば特開平 6-182228 号公報には、所定の比表面積と不純物含有量を有する炭化珪素粉末を出発原料とし、これを所望の形状に成形、乾燥後、1600～2200℃の温度範囲で焼成して得られるハニカム構造の多孔質炭化珪素質触媒担体が開示されている。

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【0004】 一方、特開昭 61-26550 号公報には、易酸化性素材、または易酸化性素材を含有する耐火組成物にガラス化素材を添加し、結合材と共に混合、混練および成形し、成形した成形体を非酸化雰囲気の中で焼成することを特徴とするガラス化素材含有耐火物の製造方法が、特開平 8-165171 号公報には、炭化珪素粉末に、有機バインダーと、粘土鉱物系、ガラス系、珪酸リチウム系の無機バインダーを添加して成形する炭化珪素成形体が、それぞれ開示されている。

【0005】 また、前記特開平 6-182228 号公報には、従来の多孔質炭化珪素質焼結体の製造方法として、骨材となる炭化珪素粒子にガラス質フラックス、あるいは粘土質などの結合材を加え成形した後、その成形

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体を前記結合材が熔融する温度で焼き固めて製造する方法も紹介されている。

【0006】 更に、特公昭61-13845号公報及び特公昭61-13846号公報には、珪砂、陶磁器粉砕物、 Al_2O_3 、 TiO_2 、 ZrO_2 等の金属酸化物、炭化珪素、窒化物、硼化物あるいはその他の耐火性材料等よりなる所定粒度に整粒された耐火性粒子が、水ガラス、フリット、釉薬等の耐火性結合材で多孔質の有底筒状体に形成された高温用セラミックフィルターについて、その好適な耐火性粒子平均径、耐火性粒子粒度分布、筒状体気孔率、筒状体平均細孔径、筒状体細孔容積、筒状体隔壁肉厚等が開示されている。

【0007】

【発明が解決しようとする課題】 しかしながら、特開平6-182228号公報に示される、炭化珪素粉末自体の再結晶反応に依る焼結形態（ネッキング）は、多孔質が得られるものの、炭化珪素粉末自体に再結晶反応を起こさせるため、非常に焼成温度が高く、これがコスト高を招き、かつ、熱膨張率の高い材料を高温焼成しなければならないために、焼成歩留が低下するという問題があった。

【0008】 一方、特開昭61-26550号公報や特開平6-182228号公報に示される、原料炭化珪素粉末をガラス質で結合させる手法は、焼成温度としては1000～1400℃と低くて済むが、この時、結合材が一旦熔融状態となるため、多孔質を得ることが非常に困難であった。

【0009】 更に、特公昭61-13845号公報及び特公昭61-13846号公報に示されるフィルターは、多孔質ではあるものの、隔壁が5～20mmと厚い有底筒状体であり、自動車排ガス浄化用フィルターのような高SV（空間速度）条件下には適用できなかった。

【0010】 本発明は、このような従来の事情に鑑みてなされたものであり、炭化珪素粒子のような耐火性粒子を含みながらも比較的低い焼成温度で安価に製造できるとともに、十分に多孔質かつ高比表面積で、目封じ等の処理により自動車排ガス浄化用のフィルターとして、或いは触媒担体等として高SV条件下でも好適に使用できるハニカム構造体とその製造方法を提供することを目的とする。

【0011】

【課題を解決するための手段】 本発明によれば、隔壁により仕切られた軸方向に貫通する多数の流通孔を有するハニカム構造体であって、耐火性粒子とガラス質成分とを含み、多孔質であることを特徴とするハニカム構造体、が提供される。

【0012】 また、本発明によれば、耐火性粒子原料にガラス化素材と有機バインダーとを添加し混合及び混練して得られた坯土をハニカム形状に成形し、得られた成形体を仮焼して成形体中の有機バインダーを除去した

後、本焼成することを特徴とするハニカム構造体の製造方法、が提供される。

【0013】

【発明の実施の形態】 前記のとおり、本発明のハニカム構造体は、耐火性粒子とともにそれら耐火性粒子を結合するためのガラス質成分を含んでいるので、その製造時において比較的低い焼成温度で焼結させることができ、製造コストを抑えるとともに歩留まりを向上させることができる。また、本発明は、特公昭61-13845号公報や特公昭61-13846号公報に示されるような厚壁の有底筒状体ではなく、多孔質のハニカム構造体であるので、自動車排ガス浄化用のフィルターや触媒担体等として高SV条件下で使用できる。

【0014】 本発明のハニカム構造体は、その微構造として、前記耐火性粒子が、その原料粒子形状を留めた状態で前記ガラス質成分により結合された構造を有することが好ましい。また、本発明のハニカム構造体を、含塵流体中に含まれる粒子状物質を捕集除去するためのフィルターとして用いる場合、その気孔率を30～90%の範囲とすることが好ましい。ハニカム構造体の気孔率が30%未満では濾過速度が不足し、90%を超えると構造体としての強度が不足する。更に、自動車排ガス浄化用フィルター等の圧力損失が懸念される用途に用いる場合には、気孔率を40%以上とすることが好ましい。

【0015】 同様に本発明のハニカム構造体をフィルターとして用いる場合、ハニカム構造体の平均細孔径は、濾過する対象に応じて決定することが好ましい。例えば、ディーゼルエンジンから排出される排気ガス中に含まれるバティキュレート捕集除去するためのディーゼルバティキュレートフィルター（DPF）として用いる場合には、平均細孔径を2～50μmの範囲とすることが好ましい。平均細孔径が2μm未満ではバティキュレートの少量堆積によっても著しく圧損が上昇し、逆に、50μmを超えるとバティキュレートの素抜けが起こるため、好ましくない。

【0016】 ハニカム構造体の流通孔（セル）を仕切る隔壁の厚さは、4mil以上（102μm以上）とすることが好ましい。隔壁の厚さが4mil（102μm）未満では、構造体としての強度が不十分である。また、強度は気孔率と密接な関係にあり、本発明のハニカム構造体の場合、隔壁の厚さと気孔率とが以下の関係を満たすように隔壁の厚さを設定すれば、必要な強度が得られ、好ましいことが判明した。

【数4】 隔壁の厚さ(μm) ≥ 気孔率(%) × 4

【0017】 更に、隔壁の厚さと気孔率とが以下の関係を満たすように隔壁の厚さを設定すれば、十分な強度が得られるため、より好ましい。

【数5】 隔壁の厚さ(μm) ≥ 気孔率(%) × 5

【0018】 一方で、DPF等のフィルターとして用いる場合には、隔壁の厚さを、50mil以下（127

0 μm以下)とすることが好ましい。隔壁の厚さが50 mil (1270 μm)を超えると、濾過速度不足や圧損上昇が懸念されるためである。なお、これについても気孔率と密接な関係があり、隔壁の厚さと気孔率とが以下の関係を満たすように隔壁の厚さを設定することによって、問題を回避することができる。

【数6】 隔壁の厚さ(μm) ≤ 気孔率(%) × 20

【0019】 ハニカム構造体のセル密度は、5～1000セル/平方インチ(0.7～155セル/cm²)の範囲とすることが好ましい。セル密度が5セル/平方インチ(0.7セル/cm²)未満では、ハニカム構造体として強度不足となるとともに、フィルターとして用いた場合には、濾過面積も不足する。逆に、1000セル/平方インチ(155セル/cm²)を超えると圧損上昇を招くため、好ましくない。

【0020】 次に、本発明のハニカム構造体の製造方法について説明する。本発明のハニカム構造体を製造するにあたっては、まず、耐火性粒子原料にガラス化素材と有機バインダーとを添加して混合及び混練し、成形用の坯土を得る。

【0021】 使用する耐火性粒子の種類は特に限定されないが、酸化物系ではAl₂O₃、ZrO₂、Y₂O₃、炭化物系ではSiC、窒化物系ではSi₃N₄、AlN、その他ムライト等の粒子が好適に用いられ、例えば、蓄積バティキュレート(蓄積バティキュレート)の燃焼処理時にしばしば高温に晒されるDPF等の用途には、SiC等が耐熱性が高く、好適に用いられる。

【0022】 耐火性粒子原料の平均粒子径は、本製造方法にて最終的に得られるハニカム構造体(焼結体)の平均細孔径の2～4倍であることが好ましい。本製造方法で得られるハニカム構造体は、焼成温度が比較的低いために耐火性粒子原料の粒子形状や粒子径が概ね焼成後まで維持される。したがって、前記比率が2倍未満であると、所望の細孔径に対して粒子径が小さ過ぎ、結果的に、小さな耐火性粒子群がガラス質で細長く結合されて大きな細孔を形成することになり、ハニカム構造体のような薄壁の構造体を維持し得る程高い強度を得ることができない。

【0023】 また、例えば耐火性粒子がSiC粒子の場合、従来多孔質ハニカム構造体に適用されてきた再結晶SiCが、その反応機構から、所望とする細孔径とほぼ同等の骨材原料粒子径を必要とするのに対し、本発明のハニカム構造体のようにガラス質成分により結合されたSiC粒子は、粒子径が細孔径の2倍以上でよいので、同じ細孔径を得ようとした時に、再結晶SiCに比べて粗い、すなわち安価な原料を使用することができ、コストメリットも大きい。

【0024】 逆に、前記比率が4倍を超える場合には、所望の細孔径に対して用いる耐火性粒子径が大き過ぎ、成形の段階で耐火性粒子を密に充填することによ

ても、その間隙に所望の細孔を得ることが困難となり、更にフィルター用途では、気孔率低下を招く点でも好ましくない。

【0025】 耐火性粒子原料中に含まれる不純物は、ガラス化素材の軟化点の降下を招き、焼結状態に影響を与えるため、その含有量を5重量%以下に抑えることが好ましい。特に、アルカリ金属、アルカリ土類金属については軟化点降下への影響が大きいため、1重量%以下に抑えることが好ましい。

【0026】 ガラス化素材は、1000℃以上で溶融してガラス質を形成するものであれば特に限定されず、例えば、耐火性粒子原料等と混合する時点ではガラス質ではなくSiO₂、Al₂O₃、B₂O₃、Na₂O、LiO₂、MgO、K₂O、CaO等のガラス化素材の1種以上の酸化物等から構成され、焼成工程においてそれ等が溶融し合ってガラス質となる生原料系の素材でもよく、また、始めからガラス質であるフリット系の素材でもよい。

【0027】 前者には、複数種の酸化物等で構成すれば溶融温度域に幅をもたせることができ、急激な溶融及び粘性低下を回避できるというメリットがあり、後者には、溶融温度域が限定できるために焼成条件を設定し易いというメリットがある。更に、本発明の製造方法におけるガラス化素材には、焼成後完全にガラス質として存在するものに限らず、例えば、溶融後に結晶化工程を経ることによって得られる結晶化ガラス等、結晶質を含むものも含まれる。また、同等の役割を果たす性質のものであれば、粘土、水ガラス、釉薬なども好適に用いられる。

【0028】 ガラス化素材は焼成中に溶けて耐火性粒子にまわりつき粒子同士を接合する役割を担うため、その適切な添加量は、耐火性粒子の表面積と密接な関わりがある。そして、この場合の耐火性粒子の表面積とは、ガラス質が溶融して覆い接着することを論じている訳であるから、粒子の形状等にも依るが、一般的には、いわゆるBET比表面積よりむしろ耐火性粒子を球体とみなした幾何学的表面積 $S = 4\pi r^2$ (r は耐火性粒子の平均粒子径)の方が適切である。この幾何学的表面積 $S = 4\pi r^2$ を用いると、「耐火性粒子単位表面積当たりのガラス素材量 W 」を、下式にて簡易的に算出することができる。

【数7】 $W = [(4/3\pi r^3 \times \rho) / (\text{耐火性粒子の重量割合})] \times [(\text{ガラス化素材の重量割合}) / (4\pi r^2)]$

(ここで、 r は耐火性粒子の平均粒径、 ρ は耐火性粒子の比重である。)

【0029】 本発明の製造方法において、ガラス化素材の添加量は、「耐火性粒子単位表面積当たりのガラス素材量 W 」が、3～30g/m²となる様、設定することが好ましい。3g/m²未満では、結合材が不足して、ハニカム構造のような薄壁の構造体を維持し得る強

度を得ることができず、逆に 30 g/m^2 を超えると、適切に耐火性粒子同士を結合し得る以上に過剰にガラス質が存在するため、強度は向上するものの、気孔率低下、平均細孔径縮小などの弊害が併発してくる。

【0030】 ガラス化素材の平均粒子径は、骨材である耐火性粒子の平均粒子径の50%以下であることが好ましい。ガラス化素材は焼成で溶けて集合しながら耐火性粒子にまわりつくように移動するため、その粒径が耐火性粒子の粒径の50%を超えると、成形時に同ガラス化素材粒子が占有していた空間が大きな空隙とな

って残り、強度低下を招いたり、フィルターとして使用する場合にはフィルター効率低下（濾過漏れ）の原因となったりする。

【0031】 また、一般に、ハニカム構造体の押出成形時には、粒度差のある原料粉末2種以上を混合する方が滑らかに押し出すことができ、その観点からは、ガラス化素材の平均粒子径を、骨材である耐火性粒子の平均粒子径の30%以下にすることが好ましい。

【0032】 耐火性粒子を骨材とし、ガラス化素材及び必要に応じて造孔剤等を配合してなる坯土を、ハニカム形状に滑らかに押出成形するため、成形助剤として、1種以上の有機バインダーを、主原料（耐火性粒子原料とガラス化素材）の合計量に対し外配で2重量%以上添加することが好ましい。しかしながら、30重量%を超える添加は、仮焼後に過剰な高気孔率を招き、強度不足に至らしめるため好ましくない。

【0033】 更に、隔壁の厚さが 20 mil （ $508\text{ }\mu\text{m}$ ）以下のハニカム構造体に押出成形する場合には、4～20重量%の範囲で添加することが好ましい。添加量が4重量%未満ではス様な薄壁に押出すことが難しく、逆に、20重量%を超えると、押出し後にその形状を維持することが困難となる。

【0034】 ハニカム構造体をフィルターとして使用する場合には、気孔率を高める目的で、坯土の調合時に造孔剤を添加してもよい。造孔剤の添加量は、主原料（耐火性粒子原料とガラス化素材）の合計量に対し、外配で30重量%以下とすることが好ましい。添加量が30重量%を超えると、過度に気孔率が高くなり強度不足に至る。造孔剤の平均粒子径は、それが燃焼して抜けた跡に気孔が形成されるため、焼成後に得ようとする平均細孔径に対し、25～100%の範囲のものを使用することが好ましい。

【0035】 前記原料を常法により混合及び混練して得られた坯土を、押出成形法等により所望のハニカム形状に成形する。次いで、得られた成形体を仮焼して成形体中に含まれる有機バインダーを除去（脱脂）した後、本焼成を行う。仮焼は、ガラス化素材が熔融する温度より低い温度にて実施することが好ましい。具体的には、 $150\sim700^\circ\text{C}$ 程度の所定の温度で一旦保持してもよく、また、所定温度域で昇温速度を 50°C/hr 以下に

遅くしてもよい。

【0036】 所定の温度で一旦保持する手法については、使用した有機バインダーの種類と量により、一温度水準のみの保持でも複数温度水準での保持でもよく、更に複数温度水準で保持する場合には、互いに保持時間を同じにしても異ならせてもよい。また、昇温速度を遅くする手法についても同様に、ある一温度区域間のみ遅くしても複数区間で遅くしてもよく、更に複数区間の場合には、互いに速度を同じとしても異ならせてもよい。

【0037】 仮焼の雰囲気については、酸化雰囲気でもよいが、成形体中に有機バインダーが多く含まれる場合には、仮焼中にそれ等が酸素で激しく燃焼して成形体温度を急激に上昇せしめることがあるため、 N_2 、 Ar 等の不活性雰囲気で行うことによって、成形体の異常昇温を抑制することも好ましい手法である。この異常昇温の抑制は、熱膨張係数の大きい（熱衝撃に弱い）原料を用いた場合に重要な制御である。有機バインダーを、例えば主原料に対して20重量%（外配）以上添加した場合には、前記不活性雰囲気にて仮焼するのが好ましい。

【0038】 仮焼とそれに続く本焼成は、同一の或いは別個の炉にて、別工程として行ってもよく、また、同一炉での連続工程としてもよい。仮焼と本焼成を異なる雰囲気にて実施する場合には前者も好ましい手法であるが、総焼成時間、炉の運転コスト等の見地からは後者の手法も好ましい。

【0039】 本焼成の温度は、用いるガラス化素材によって異なるが、通常 $1000\sim1600^\circ\text{C}$ の範囲で実施することが好ましい。本焼成の実施温度が 1000°C 未満では、ガラス化素材の熔融が十分におこなわないため耐火性粒子同士が強固に結合されず、逆に、 1600°C を超えると、熔融したガラス化素材の粘性が低下し過ぎて焼成体表面近傍や焼成体下部に集中する等の偏りが生じるため好ましくない。

【0040】 また、本焼成の雰囲気については、耐火性粒子の種類によって選択することが好ましく、例えば、 SiC をはじめとする炭化物の粒子、 Si_3N_4 、 AlN に代表される窒化物の粒子等、高温での酸化が懸念されるものについては、少なくとも酸化が始まる温度以上の温度域においては、 N_2 、 Ar 等の非酸化雰囲気とすることが好ましい。

【0041】

【実施例】 以下、本発明を実施例に基づいて更に詳細に説明するが、本発明はこれらの実施例に限定されるものではない。

【0042】（実施例1）平均粒径 $50.0\text{ }\mu\text{m}$ の SiC 原料粉末85重量部、平均粒径 $10.8\text{ }\mu\text{m}$ のガラス化素材15重量部、有機バインダーとしてメチルセルロース6重量部、造孔剤としてグラファイト5重量部、界面活性剤2.5重量部、及び水24重量部を均一に混合及び混練して得た坯土を、押出し成形機にて外径45m

m、長さ120mm、隔壁厚さ0.43mm、セル密度100セル/平方インチ(16セル/cm²)のハニカム形状に成形した。このハニカム成形体を酸化雰囲気において550℃で3時間、脱脂のため仮焼を行った後、非酸化雰囲気において1400℃で2.5時間の焼成を行い、多孔質でハニカム構造の炭化珪素焼結体を作製した。この焼結体について、水銀ポロシメーターにて平均細孔径と気孔率、更に3点曲げ強度を測定し、その結果を表1に示した。なお、3点曲げ強度は下記計算式を用いて算出した。

$$[\text{数}8] \sigma = (F \times S) / (4 \times Z)$$

(ここで、 σ は3点曲げ強度、Fは荷重、Sは下部スパン間隔(35mm)、Zは断面2次モーメントである。)

【0043】(実施例2)平均粒径32.6 μ mのSiC原料粉末を用いた以外は、前記実施例1と同様に混練、成形及び焼成を行って焼結体を得た。得られた焼結体について、前記実施例1と同様に平均細孔径、気孔率及び3点曲げ強度を測定し、その結果を表1に示した。

【0044】(実施例3)SiC原料粉末を70重量部、ガラス化素材を30重量部とした以外は、前記実施例1と同様に混練、成形及び焼成を行って焼結体を得

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た。得られた焼結体について、前記実施例1と同様に平均細孔径、気孔率及び3点曲げ強度を測定し、その結果を表1に示した。

【0045】(実施例4)平均粒径32.6 μ mのSiC原料粉末を用い、SiC原料粉末を65重量部、ガラス化素材を35重量部とした以外は、前記実施例1と同様に混練、成形及び焼成を行って焼結体を得た。得られた焼結体について、前記実施例1と同様に平均細孔径、気孔率及び3点曲げ強度を測定し、その結果を表1に示した。

【0046】(実施例5)前記実施例1～4より大径のハニカム構造体を作製した場合、もしくは有機バインダーをより多く含んだ坯土を用いてハニカム構造体を作製した場合、前記実施例1～4と同様に酸化雰囲気下で脱脂のための仮焼を行っても、歩留まり90%以上に同様の特性の焼結体を得る事ができたが、不活性雰囲気下で仮焼を行うと、セル切れ等の不具合が発生すること無く、不良率0%で良好な焼結体を得ることが出来た。

【0047】

【表1】

	SiC粉末の 平均粒径(μ m)	SiC粉末の 配合量(重量部)	ガラス化素材の 配合量(重量部)	平均細孔径 (μ m)	気孔率 (%)	強度 (kgf/mm ²)	SiC粉末平均粒径 /焼結体平均細孔径	ガラス化素材添加量 /SiC粉末表面積
実施例1	50.0	85	15	16.6	43.2	2.59	3.01	9.18
実施例2	32.6	85	15	10.3	48.4	2.28	3.17	5.98
実施例3	50.0	70	30	19.5	30.9	4.38	2.56	22.29
実施例4	32.6	65	35	13.0	38.6	5.39	2.51	18.26

【0048】これらの結果から、必要とする平均細孔径のハニカム構造体を得るために原料SiC粉末の粒径を容易に選択することができる。また、ガラス化素材の添加量についても過不足なく設定でき、要求されるハニカム構造体を安価に製造することができる。

【0049】

【発明の効果】以上説明したように、本発明のハニカ

※ム構造体は、炭化珪素粒子等の耐火性粒子を含みながらも、その製造時において比較的低い焼成温度で焼結させることができるので、製造コストを抑えるとともに歩留まりも向上し、安価に提供することができる。また、多孔質のハニカム構造体であるので、自動車排ガス浄化用のフィルターや触媒担体等として高SV条件下でも好適に使用できる。

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CLAIMS

[Claim(s)]

[Claim 1] The honeycomb structure object which is a honeycomb structure object which has the circulation hole of a large number penetrated to the shaft orientations divided by the septum, and is characterized by being porosity including a fireproof particle and a glassiness component.

[Claim 2] The honeycomb structure object according to claim 1 which has the structure combined by said glassiness component after said fireproof particle had stopped the raw material particle shape.

[Claim 3] The honeycomb structure object according to claim 1 said whose fireproof particle is a silicon carbide particle.

[Claim 4] The honeycomb structure object according to claim 1 used as a filter which carries out uptake removal of the particulate matter contained in dust-containing fluid.

[Claim 5] The honeycomb structure object according to claim 1 in the range whose porosity is 30 - 90%.

[Claim 6] The honeycomb structure object according to claim 1 in the range whose average pore size is 2-50 micrometers.

[Claim 7] The honeycomb structure object according to claim 1 whose thickness of said septum is 102-1270 micrometers.

[Claim 8] The honeycomb structure object according to claim 1 with which the thickness of said septum and the porosity of a honeycomb structure object fill the following relation.

[Equation 1] thickness (micrometer) \geq porosity (%) $\times 4$ of a septum -- [Claim 9] The honeycomb structure object according to claim 1 with which the thickness of said septum and the porosity of a honeycomb structure object fill the following relation.

[Equation 2] thickness (micrometer) \geq porosity (%) $\times 5$ of a septum -- [Claim 10] The honeycomb structure object according to claim 1 with which the thickness of said septum and the porosity of a honeycomb structure object fill the following relation.

[Equation 3] thickness (micrometer) \leq porosity (%) $\times 20$ of a septum -- [Claim 11] The honeycomb structure object according to claim 1 whose cel consistencies are 0.7 - 155 cel / cm².

[Claim 12] The manufacture approach of the honeycomb structure object characterized by carrying out actual baking after adding a vitrification material and an organic binder in a fireproof particle raw material, fabricating the plastic matter mixed, and kneaded and obtained in a honeycomb configuration, carrying out temporary quenching of the acquired Plastic solid and removing the organic binder in a Plastic solid.

[Claim 13] The manufacture approach according to claim 12 that said fireproof particle raw material is a silicon carbide particle raw material.

[Claim 14] The manufacture approach according to claim 12 that the mean particle diameter of said fireproof particle raw material is 2 to 4 times the average pore size of the honeycomb structure object finally acquired.

[Claim 15] The manufacture approach according to claim 12 that the impurity content of said fireproof particle raw material is 5 or less % of the weight.

[Claim 16] The manufacture approach according to claim 12 constituted including one or more sorts of oxides chosen from the group which said vitrification material becomes from SiO₂, aluminum 2O₃, B₂O₃, and Na₂O.

[Claim 17] The manufacture approach according to claim 12 that the addition of said vitrification

material is 3 - 30 g/m² to the surface area of a fireproof particle.

[Claim 18] The manufacture approach according to claim 12 that the mean particle diameter of a vitrification material is 50% or less of the mean particle diameter of the fireproof particle which is the aggregate.

[Claim 19] The manufacture approach according to claim 12 which adds said organic binder in 2 - 30% of the weight of the range by outside ** to the total quantity of said fireproof particle raw material and vitrification material.

[Claim 20] The manufacture approach according to claim 12 which adds an ostomy agent in 30 or less % of the weight of the range by outside ** to the total quantity of said fireproof particle raw material and vitrification material in case said plastic matter is prepared.

[Claim 21] The manufacture approach according to claim 12 of carrying out temporary quenching of said Plastic solid at temperature lower than the temperature which said vitrification material fuses.

[Claim 22] The manufacture approach according to claim 12 of carrying out said this baking in a 1000-1600-degree C temperature requirement.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the honeycomb structure object used for a filter, catalyst support, etc. for automobile exhaust purification.

[0002]

[Description of the Prior Art] The porous honeycomb structure object is widely used as catalyst support for supporting the catalyst component which purifies the filter for carrying out uptake removal of the particulate matter contained in dust-containing fluid like diesel-power-plant exhaust gas, or the harmful matter in exhaust gas. Moreover, using a fireproof particle like a silicon carbide (SiC) particle as a component of such a honeycomb structure object is known.

[0003] As a concrete related technique, the silicon carbide powder which has a predetermined specific surface area and a predetermined impurity content is used as a start raw material, and the nature catalyst support of porosity silicon carbide of the honeycomb structure calcinated and acquired by the configuration of a request of this after shaping and desiccation in a 1600-2200-degree C temperature requirement is indicated by JP,6-182228,A.

[0004] A vitrification material adds to the fireproof constituent which, on the other hand, contains an easy-oxidizable material or an easy-oxidizable material in JP,61-26550,A, and the silicon-carbide Plastic solid with which the manufacture approach of the vitrification material content refractories characterized by to carry out nakedness baking of the Plastic solid mixed, kneaded, and fabricated and fabricated in the furnace of a non-oxidizing atmosphere adds and fabricates an organic binder and the inorganic binder of a clay mineral system, textile glass yarn, and a silicic-acid lithium system to silicon-carbide powder at JP,8-165171,A is indicated with binding material, respectively.

[0005] Moreover, after adding and fabricating binding material, such as glassiness flux or argillaceous, to the silicon carbide particle used as the aggregate as the manufacture approach of the conventional nature sintered compact of porosity silicon carbide, the method of burning, hardening and manufacturing the Plastic solid at the temperature which said binding material fuses is also introduced to said JP,6-182228,A.

[0006] furthermore, to JP,61-13845,B and JP,61-13846,B Silica sand, a pottery grinding object, aluminum₂O₃, TiO₂, the metallic oxide of ZrO₂ grade, The fireproof particle by which the particle size regulation was carried out to the predetermined grain size which consists of silicon carbide, a nitride, boride, or other fireproof ingredients The suitable fireproof particle pitch diameter, fireproof particle particle size distribution, tube-like object porosity, tube-like object average pore size, tube-like object pore volume, tube-like object septum thickness, etc. are indicated about the high-temperature-service ceramic filter formed in the porous cylinder-like-object-with-base-like object with fireproof binding material, such as water glass, a frit, and a cover coat.

[0007]

[Problem(s) to be Solved by the Invention] However, although porosity is acquired, since the sintering gestalt (necking) which is shown in JP,6-182228,A and which depends on the recrystallization reaction of the silicon carbide powder itself made the silicon carbide powder itself cause a recrystallization reaction, it was [burning temperature] very high, and it had the problem that a baking yield fell in order for this to have to cause cost quantity and to have to carry out elevated-temperature baking of the ingredient with a high coefficient of thermal expansion.

[0008] Although the technique of on the other hand combining the coal-for-coke-making-ized silicon powder shown in JP,61-26550,A or JP,6-182228,A by glassiness was low and ended with 1000-1400 degrees C as a burning temperature, since binding material will once be in a melting condition at this time, it was very difficult to acquire porosity.

[0009] Furthermore, although the filter shown in JP,61-13845,B and JP,61-13846,B was porosity, septa are 5-20mm and a thick cylinder-like-object-with-base-like object, and were not able to apply it to the bottom of a high SV (space velocity) condition like the filter for automobile exhaust purification.

[0010] This invention is fully porosity and high specific surface area, and aims at offering the honeycomb structure object which can be suitably used also under high SV conditions as catalyst support etc. as a filter for automobile exhaust purification by processing of ***** etc., and its manufacture approach while being able to manufacture them cheaply with a comparatively low burning temperature, though it is made in view of such a conventional situation and a fireproof particle like a silicon carbide particle is included.

[0011]

[Means for Solving the Problem] According to this invention, it is the honeycomb structure object which has the circulation hole of a large number penetrated to the shaft orientations divided by the septum, and honeycomb structure object ** characterized by being porosity is offered including a fireproof particle and a glassiness component.

[0012] Moreover, after according to this invention adding a vitrification material and an organic binder in a fireproof particle raw material, fabricating the plastic matter mixed, and kneaded and obtained in a honeycomb configuration, carrying out temporary quenching of the acquired Plastic solid and removing the organic binder in a Plastic solid, manufacture approach ** of the honeycomb structure object characterized by carrying out actual baking is offered.

[0013]

[Embodiment of the Invention] Since the glassiness component for the honeycomb structure object of this invention to combine these refractoriness particle with a fireproof particle as aforementioned is included, it can be made to sinter with a comparatively low burning temperature at the time of the manufacture, and the yield can be raised while holding down a manufacturing cost. Moreover, since this invention is not the cylinder-like-object-with-base-like object of a thick wall as shown in JP,61-13845,B or JP,61-13846,B but a porous honeycomb structure object, it can be used under high SV conditions as a filter, catalyst support, etc. for automobile exhaust purification.

[0014] As for the honeycomb structure object of this invention, it is desirable to have the structure combined by said glassiness component as the microstructure after said fireproof particle had stopped the raw material particle shape. Moreover, when using the particulate matter contained in dust-containing fluid in the honeycomb structure object of this invention as a filter for carrying out uptake removal, it is desirable to make the porosity into 30 - 90% of range. If the porosity of a honeycomb structure object runs short of filtration velocity at less than 30% and exceeds 90%, the reinforcement as the structure runs short. Furthermore, when using for the application for which we are anxious about the pressure loss of the filter for automobile exhaust purification etc., it is desirable to make porosity into 40% or more.

[0015] When using the honeycomb structure object of this invention as a filter similarly, as for the average pore size of a honeycomb structure object, determining according to the object to filter is desirable. For example, when using as a diesel particulate filter (DPF) for carrying out uptake removal of the particulate contained in the exhaust gas discharged from a diesel power plant, it is desirable to make average pore size into the range of 2-50 micrometers. if a pressure loss goes up remarkably and it exceeds 50 micrometers conversely also by little deposition of a particulate [pore size / average] in less than 2 micrometers -- particulate base -- since an omission happens, it is not desirable.

[0016] As for the thickness of the septum with which the circulation hole (cel) of a honeycomb structure object is divided, it is desirable to be referred to as 4 or more (102 micrometers or more) mil. Under 4mil (102 micrometers) of the reinforcement as the structure is [the thickness of a septum] insufficient. Moreover, reinforcement It had porosity and a close relation, when in the case of the honeycomb structure object of this invention setting up the thickness of a septum so that the

thickness and the porosity of a septum might fill the following relation, required reinforcement was obtained, and the desirable thing became clear.

[Equation 4] Thickness (micrometer) \geq porosity (%) $\times 4$ [0017] of a septum Furthermore, if the thickness of a septum is set up so that the thickness and the porosity of a septum may fill the following relation, since sufficient reinforcement will be obtained, it is more desirable.

[Equation 5] Thickness (micrometer) \geq porosity (%) $\times 5$ [0018] of a septum On the other hand, when using as filters, such as DPF, it is desirable to set thickness of a septum to 50 or less (1270 micrometers or less) mil. When the thickness of a septum exceeds 50mil (1270 micrometers), it is for being anxious about the lack of filtration velocity, or a pressure drop buildup. In addition, there is close relation to porosity also about this, and a problem can be avoided by setting up the thickness of a septum so that the thickness and the porosity of a septum may fill the following relation.

[Equation 6] Thickness (micrometer) \leq porosity (%) $\times 20$ [0019] of a septum As for the cel consistency of a honeycomb structure object, it is desirable to consider as the range of 5-1000 cel / square inch (0.7 - 155 cel / cm²). a cel consistency -- 5 cels / square -- under in an inch (0.7 cels / cm²), while becoming insufficient [reinforcement] as a honeycomb structure object, when it uses as a filter, filtration areas also run short. On the contrary, it is not desirable in order to cause a pressure drop buildup, if 1000 cel / square inch (155 cels / cm²) is exceeded.

[0020] Next, the manufacture approach of the honeycomb structure object of this invention is explained. In manufacturing the honeycomb structure object of this invention, first, a vitrification material and an organic binder are added in a fireproof particle raw material, it mixes and kneads in it, and the plastic matter for shaping is obtained.

[0021] although especially the class of fireproof particle to be used is not limited -- an oxide system - - aluminum₂ -- O₃, ZrO₂, Y₂O₃, and a carbide system -- SiC and a nitride system -- Si₃ -- thermal resistance of SiC is high for applications, such as DPF which particles, such as N₄, AlN, and other mullites, are used suitably, for example, is often exposed to an elevated temperature at the time of combustion processing of an are recording particulate, and it is suitably used for them.

[0022] As for the mean particle diameter of a fireproof particle raw material, it is desirable that it is 2 to 4 times the average pore size of the honeycomb structure object (sintered compact) finally acquired by this manufacture approach. Since the honeycomb structure object acquired by this manufacture approach has a comparatively low burning temperature, the particle shape and the particle diameter of a fireproof particle raw material are maintained in general until after baking. Therefore, such reinforcement high [particle diameter is too small to desired pore size in said ratio being under 2 double, and] cannot be obtained that it will be combined long and slender by glassiness, and a fireproof small particle group will form big pore and can maintain the structure of a thin wall like a honeycomb structure object as a result.

[0023] Moreover, for example, the recrystallization SiC conventionally applied to the porosity honeycomb structure object when a fireproof particle is a SiC particle The SiC particle combined by the glassiness component from the reaction mechanism like the honeycomb structure object of this invention to needing aggregate raw material particle diameter almost equivalent to the pore size considered as a request Since **** [particle diameter / twice / more than / the pore size], when it is going to obtain the same pore size, compared with Recrystallization SiC, a cheap raw material can be used coarsely, and a cost merit is also large.

[0024] On the contrary, when said ratio exceeds 4 times, the fireproof particle diameter used to desired pore size is too large, and it is not desirable by being densely filled up with a fireproof particle in the phase of shaping at the point which becomes difficult [it / to obtain desired pore] for the gap, and causes a porosity fall for a filter application further.

[0025] Since the impurity contained in a fireproof particle raw material causes descent of the softening temperature of a vitrification material and affects a sintering condition, it is desirable to stop the content to 5 or less % of the weight. Since the effect on softening temperature descent is large about alkali metal and especially alkaline earth metal, it is desirable to stop to 1 or less % of the weight.

[0026] A vitrification material will not be limited, especially if it fuses above 1000 degrees C and glassiness is formed. When mixing with a fireproof particle raw material etc., for example, not glassiness but SiO₂ and aluminum 2O₃, B-2 O₃, Na₂O, The material of a raw raw material system

which it consists of one or more sorts of oxides of vitrification materials, such as LiO_2 , MgO , K_2O , and CaO , etc., and it etc. fuses each other in a baking process, and serves as glassiness is sufficient, and the material of the frit system which is glassiness from the start is sufficient.

[0027] If constituted from two or more sorts of oxides etc. to the former Since width of face can be given to a melting temperature region, there is a merit that rapid melting and a rapid viscous fall are avoidable and a melting temperature region can be limited to the latter There is a merit of being easy to set up baking conditions. Furthermore, what [not only] exists as glassiness completely after baking but the thing containing crystalline substances, such as glass ceramics obtained by passing through a crystallization process for example, after melting, is contained in the vitrification material in the manufacture approach of this invention. Moreover, if it is the thing of a property which plays an equivalent role, clay, water glass, a cover coat, etc. will be used suitably.

[0028] Vitrification material Since the role which melts during baking, coils around a fireproof particle, and joins particles is borne, the suitable addition has the close relation with the surface area of a fireproof particle. and wholly more nearly geometric [rather / particle / fireproof / in a solid sphere / the bottom] generally than the so-called BET specific surface area, although it depends on the configuration of a particle etc. since the surface area of the fireproof particle in this case is a translation which is arguing that glassiness fuses, and covers and pastes up -- surface area $S=4\pi r^2$ (r is the mean particle diameter of a fireproof particle) is more suitable. this -- geometric -- if surface area $S=4\pi r^2$ are used, "the amount W of glass materials per fireproof particle unit surface area" is computable in simple by the bottom formula.

[Equation 7] $W = [(4/3\pi r^3 \rho) / (\text{weight rate of a fireproof particle})] \times [(\text{weight rate of a vitrification material}) / (4\pi r^2)]$ (here, r is the mean particle diameter of a fireproof particle, and ρ is the specific gravity of a fireproof particle.)

[0029] As for the addition of a vitrification material, in the manufacture approach of this invention, it is desirable the appearance from which "the amount W of glass materials per fireproof particle unit surface area" serves as 3 - 30 g/m^2 , and to set up. In less than two 3 g/m^2 , since glassiness exists superfluously more than it can combine fireproof particles appropriately if binding material is insufficient, and the reinforcement which can maintain the structure of a thin wall like honeycomb structure cannot be obtained but 30 g/m^2 is exceeded conversely, although reinforcement improves, evils, such as a porosity fall and average pore size contraction, occur at the same time.

[0030] As for the mean particle diameter of a vitrification material, it is desirable that it is 50% or less of the mean particle diameter of the fireproof particle which is the aggregate. Vitrification material In order to move melting and gathering by baking so that it may coil around a fireproof particle, the particle size If 50% of the particle size of a fireproof particle is exceeded, when it becomes a big opening and it remains, and it will cause a fall on the strength or the space which this vitrification material particle occupied will use it as a filter at the time of shaping It becomes the cause of filter degradation (leakage in filtration).

[0031] Moreover, it is desirable for the direction which generally mixes two or more sorts of raw material powder with a grain-size difference at the time of extrusion molding of a honeycomb structure object to be able to extrude smoothly, and to make mean particle diameter of a vitrification material into 30% or less of the mean particle diameter of the fireproof particle which is the aggregate from the viewpoint.

[0032] In order to use a fireproof particle as the aggregate and to carry out extrusion molding of the plastic matter which comes to blend an ostomy agent etc. a vitrification material and if needed to a honeycomb configuration smoothly, it is desirable to add one or more sorts of organic binders 2% of the weight or more by outside ** as a shaping assistant to the total quantity of the main raw material (a fireproof particle raw material and vitrification material). However, in order that the addition exceeding 30 % of the weight may cause superfluous high porosity and may make the lack of on the strength result after temporary quenching, it is not desirable.

[0033] Furthermore, when the thickness of a septum carries out extrusion molding to the honeycomb structure object below 20mil (508 micrometers), it is desirable to add in 4 - 20% of the weight of the range. an addition -- less than 4 % of the weight -- ** -- if it is difficult to extrude in a thin wall [like] and it exceeds 20 % of the weight conversely, it will become difficult to maintain the configuration after extrusion.

[0034] When using a honeycomb structure object as a filter, an ostomy agent may be added at the time of preparation of a plastic matter in order to raise porosity. As for the addition of an ostomy agent, it is desirable to consider as 30 or less % of the weight by outside ** to the total quantity of the main raw material (a fireproof particle raw material and vitrification material). If an addition exceeds 30 % of the weight, porosity will become high too much and it will result in the lack of on the strength. Since pore is formed in the marks from which it burned and escaped, as for the mean particle diameter of an ostomy agent, it is desirable to use the thing of 25 - 100% of range to the average pore size which it is going to obtain after baking.

[0035] Said raw material is fabricated in the honeycomb configuration of a request of the plastic matter mixed, and kneaded and obtained by the conventional method by an extrusion method etc. Subsequently, this baking is performed after removing the organic binder which carries out temporary quenching of the acquired Plastic solid, and is contained in a Plastic solid (cleaning). As for temporary quenching, it is desirable to carry out at temperature lower than the temperature which a vitrification material fuses. You may once hold at the predetermined temperature of about 150-700 degrees C, and, specifically, a programming rate may be made late in a predetermined temperature region at below 50 degrees C / hr.

[0036] About the technique once held at predetermined temperature, with the class and amount of an organic binder which were used, maintenance or maintenance with the two or more temperature level of only a 1 temperature level is sufficient, and in holding with the two or more temperature level further, even if the same, you may change the holding time mutually. Moreover, between a certain 1 temperature-province regions may be similarly made late about the technique of making a programming rate late, or you may make it late among the two or more division, and, in between the two or more [further] division, a rate may be mutually changed also as the same.

[0037] Although an oxidizing atmosphere is sufficient, in order that it etc. may burn violently with oxygen and may make Plastic solid temperature rise rapidly during temporary quenching about the ambient atmosphere of temporary quenching when many organic binders are contained in a Plastic solid, it is also desirable technique by carrying out by inert atmospheres, such as N₂ and Ar, to control the abnormality temperature up of a Plastic solid. Control of this abnormality temperature up is important control when a raw material with a large (weak to a thermal shock) coefficient of thermal expansion is used. It is desirable to carry out temporary quenching of the organic binder in said inert atmosphere, when it adds more than 20 % of the weight (outside **) for example, to the main raw material.

[0038] Or this baking following temporary quenching and it is identitas, at a separate furnace, you may carry out as another process and it is good also as a continuous process in the same furnace. When carrying out temporary quenching and this baking in a different ambient atmosphere, the former is desirable technique, and from standpoints, such as the total firing time and operation cost of a furnace, the latter technique is also desirable.

[0039] Although the temperature of this baking changes with vitrification materials to be used, it is desirable to usually carry out in 1000-1600 degrees C. Since the bias of fireproof particles not being firmly combined in order that melting of a vitrification material may not fully start, but the viscosity of the vitrification material fused when it exceeded 1600 degrees C conversely falling too much at less than 1000 degrees C, and concentrating on the baking object lower part near the baking body surface arises, the operation temperature of this baking is not desirable.

[0040] moreover, the thing chosen according to the class of fireproof particle about the ambient atmosphere of this baking -- desirable -- for example, the particle of carbide including SiC and Si₃ -- the particle of the nitride represented by N₄ and AlN of considering as non-oxidizing atmospheres, such as N₂ and Ar, etc. is desirable in the temperature region beyond the temperature from which oxidation begins at least about what is anxious about the oxidation in an elevated temperature.

[0041]

[Example] Hereafter, although this invention is further explained to a detail based on an example, this invention is not limited to these examples.

[0042] The SiC raw material powder 85 weight section with a mean particle diameter of 50.0 micrometers, the vitrification material 15 weight section with a mean particle diameter of 10.8 micrometers, (Example 1) As an organic binder, as the methyl cellulose 6 weight section and an

ostomy agent The graphite 5 weight section, **** which mixed and kneaded and obtained the surfactant 2.5 weight section and the water 24 weight section to homogeneity was fabricated with the extrusion-molding machine in 0.43mm in the outer diameter of 45mm, die length of 120mm, and septum thickness, and the honeycomb configuration of cel consistency 100 cel / square inch (16 cels / cm²). After performing temporary quenching for this honeycomb Plastic solid at 550 degrees C in an oxidizing atmosphere for 3 hours for cleaning, in the non-oxidizing atmosphere, baking of 2.5 hours was performed at 1400 degrees C, and the silicon carbide sintered compact of honeycomb structure was produced by porosity. About this sintered compact, average pore size, porosity, and three more point flexural strength were measured in the mercury porosimeter, and that result was shown in Table 1. In addition, three-point flexural strength was computed using the following formula.

[Equation 8] $\sigma = (F \times S) / (4 \times Z)$ (here, for sigma, three-point flexural strength and F are [lower span spacing (35mm) and Z of a load and S] cross-section second moments.)

[0043] (Example 2) Except having used SiC raw material powder with a mean particle diameter of 32.6 micrometers, kneading, shaping, and baking were performed like said example 1, and the sintered compact was obtained. About the obtained sintered compact, average pore size, porosity, and three-point flexural strength were measured like said example 1, and the result was shown in Table 1.

[0044] (Example 3) Except having made SiC raw material powder into 70 weight sections, and having made the vitrification material into 30 weight sections, kneading, shaping, and baking were performed like said example 1, and the sintered compact was obtained. About the obtained sintered compact, average pore size, porosity, and three-point flexural strength were measured like said example 1, and the result was shown in Table 1.

[0045] (Example 4) Using SiC raw material powder with a mean particle diameter of 32.6 micrometers, except having made SiC raw material powder into 65 weight sections, and having made the vitrification material into 35 weight sections, kneading, shaping, and baking were performed like said example 1, and the sintered compact was obtained. About the obtained sintered compact, average pore size, porosity, and three-point flexural strength were measured like said example 1, and the result was shown in Table 1.

[0046] When the honeycomb structure object of a major diameter is produced from said examples 1-4, (Example 5) Or although the sintered compact of the property same at 90% or more of yields was able to be obtained even if it performed temporary quenching for cleaning under the oxidizing atmosphere like said examples 1-4 when a honeycomb structure object was produced using the plastic matter containing more organic binders The good sintered compact was able to be obtained at 0% of percent defectives, without generating the fault of a cel piece etc., when temporary quenching was performed under the inert atmosphere.

[0047]

[Table 1]

	S i C粉末の 平均粒径(μm)	S i C粉末の 配合量(重量部)	ガラス化素材の 配合量(重量部)	平均細孔径 (μm)	気孔率 (%)	強度 (kgf/mm ²)	S i C粉末平均粒径 / 焼結体平均細孔径	ガラス化素材添加量 / S i C粉末表面積
実施例 1	50.0	85	15	16.6	43.2	2.59	3.01	9.18
実施例 2	32.6	85	15	10.3	48.4	2.28	3.17	5.98
実施例 3	50.0	70	30	19.5	30.9	4.36	2.56	22.29
実施例 4	32.6	65	35	13.0	38.6	5.39	2.51	18.26

[0048] In order to acquire the honeycomb structure object of average pore size to need from these results, the particle size of raw material SiC powder can be chosen easily. Moreover, it can set up the neither more nor less also about the addition of a vitrification material, and the honeycomb structure object demanded can be manufactured cheaply.

[0049]

[Effect of the Invention] As explained above, though fireproof particles, such as a silicon carbide particle, are included, since it can be made to sinter with a comparatively low burning temperature at

the time of the manufacture, the honeycomb structure object of this invention can improve [yield's] while holding down a manufacturing cost, and can be offered cheaply. Moreover, since it is a porous honeycomb structure object, it can be suitably used also under high SV conditions as a filter, catalyst support, etc. for automobile exhaust purification.

[Translation done.]

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